Operable Unit 3-13, Group 3, Other Surface Soils, CPP-37B and CPP-37C Characterization Results Report

May 2006

Idaho Cleanup Project

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Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14516

ABSTRACT

This Characterization Report presents and discusses post-Record of Decision sampling data gathered on Sites CPP-37B and CPP-37C to assist in determining if the need exists to remediate the sites. This report is identified as one of the deliverables outlined in the Operable Unit 3-13, Group 3, Remedial Design/Remedial Action Work Plan, DOE/ID-11089. Data and discussion are presented that show the CPP-37B and CPP-37C sites are below the remediation goals specified in the Operable Unit 3-13 Record of Decision.

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ACRONYMS

bgs	below ground surface
COCs	contaminants of concern
CP	characterization plan
D&D	decontamination and dismantlement
DOE	Department of Energy
GPS	global positioning system
HLW	high-level waste
HPGe	high-purity germanium
INL	Idaho National laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
L&V	limitations and validation
log-normal	natural logarithm-normal distribution
MDA	minimum detectable activity
MDC	minimum detectable concentration
OU	operable unit
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RD/RAWP	remedial design/remedial action work plan
RGs	remediation goals
RI/BRA	remedial investigation/baseline risk assessment
ROD	Record of Decision
SNF	spent nuclear fuel
TDEMI	time domain electromagnetic induction
UCL	upper confidence level
WAG	waste area group
WCF	Waste Calcining Facility

Operable Unit 3-13, Group 3, Other Surface Soils, CPP-37B and CPP-37C Characterization Results Report

1. INTRODUCTION

1.1 Objective

This Characterization Report was prepared and submitted in partial fulfillment of a requirement established in the Remedial Design/Remedial Action Work Plan (RD/RAWP) (DOE-ID 2004) for Operable Unit (OU) 3-13, Group 3, Other Soil Sites, at the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Laboratory (INL) Site. The RD/RAWP states in Section 5.1.4 that

> The characterization sampling and analytical results … will be submitted to the Agencies under two different submittals. The first submittal will be the Characterization Results Report for Remediation Set 1…
>
> The second submittal will be the Characterization Results Report for Remediation Sets 2 & 3. This report will present the validated analytical data for the sampling of Sites CPP-37B and -37C. This report will provide results showing that at Sites CPP-37B/C remediation may or may not be required and present the path forward for remediation of all the sites, as necessary. This will be a secondary document, subject to the standard FFA/CO review cycle for secondary documents...

The objective of this Characterization Report is to present and summarize the post-Record of Decision (ROD) sampling data collected on the INTEC Sites CPP-37B and CPP-37C. Sites CPP-37B and CPP-37C are currently designated as belonging to OU 3-13, Group 3, Other Soil Sites, Remediation Set 2. It is a further objective that the results are presented in a manner that is useful in determining (a) if the sites require remediation and (b) a recommended path forward.

1.2 Background

The ROD for INTEC, Waste Area Group (WAG) 3, was issued in October 1999 (DOE-ID 1999). The ROD addressed the known contaminant releases at WAG 3 resulting from spent nuclear fuel (SNF) reprocessing, storage and research, and ancillary activities except for those releases associated with the tank farm. Postclosure monitoring of closed units, such as the Waste Calcining Facility (WCF), and past releases of hazardous substances from Resource Conservation and Recovery Act (RCRA) regulated units were also addressed. Closure or decontamination and dismantlement (D&D) of high-level waste (HLW) units were not included, but past releases of hazardous substances from these units were addressed.

INTEC is one of 10 WAGs at the INL Site and was designated as WAG 3. WAG 3 contains a number of contaminant release sites grouped into OUs based on similarity of waste streams and projected remedial actions. Fourteen OUs were defined for WAG 3. OU 3-01 through OU 3-13 were addressed in the ROD. OU 3-13 sites were further categorized into seven groups relating to media, similar contamination, or geographic proximity. These groups are discussed and defined in the ROD.

Group 3 sites identified in the ROD included CPP-37B, which is a former gravel pit located inside the current INTEC security fence. The site was previously used for disposal of wastewaters from the old Sewage Treatment Plant and subsequently used for disposal of construction debris. The ROD defines CPP-37B in Section 5.3.3.18 as

> … located inside the INTEC security fence. Before being backfilled, the site was approximately 79 m (260 ft) in width, 116 m (380 ft) in length and was 7.9-m (26-ft) deep and area of approximately 9,179 m^2 (98,800 ft^2). Prior to 1982, this pit was often used to dispose of waters released from the sludge dewatering pit of the old STP (CPP-715). After 1982, the pit was used to dispose of construction debris, some of which may have been radionuclide contaminated… Additionally, the CPP-37B was open in 1964 when the release of radioactive steam associated with Site CPP-26 occurred. Radioactive steam containing Cs-137 was released from a decontamination header in the HLLW Tank Farm. The year this pit was backfilled is unknown, but it is believed to have been backfilled to grade shortly after its use as a construction debris landfill was discontinued. Modeling and sampling of the site indicated the site is not a significant contributor to groundwater risk or surface exposure risk. However, since the pit was previously used as a landfill, characterization is considered insufficient to recommend no further action at the site.

The results of the remedial investigation/baseline risk assessment (RI/BRA) (DOE-ID 1997) indicated that the major threat posed by the Group 3 sites is external exposure to radionuclides. Table 7-7 of the ROD states the conclusion that "The potential increased cancer incidence at this release site [CPP-37B] is less than 1E-04 under all land use assumptions: therefore, further evaluation in the OU 3-13 Feasibility Study is not warranted."

Section 5.1.1.5 of the RD/RAWP (DOE-ID 2004) states the following for CPP-37B:

> The following excerpt is from Section 5.3.3.18, CPP-37b, Gravel Pit and Debris Disposal Pit 2, of the OU 3-13 ROD (DOE-ID 1999):
>
> Modeling and sampling of the site indicated the site is not a significant contributor to groundwater risk or surface exposure risk. However, since the pit was previously used as a landfill, characterization is considered insufficient to recommend no further action at the site.

DOE-ID (2004) further asserted

> … the existing CPP-37B data are insufficient to determine whether RGs are exceeded at this site. Previous sampling did not analyze for Eu-152 and Eu-154. Therefore, additional characterization data are needed to determine if remediation of this site is necessary.

Site CPP-37C was not identified in the ROD. Rather, it was established in 2002 after contamination was discovered in November 2000, southeast of, and adjacent to, CPP-37B while digging a trench along the fence near the east perimeter road. This contamination included construction debris (mostly lava rock, gravel, and soil and minor amounts of concrete, plywood, pipe, and plastic) located approximately 5 to 6 ft below ground surface (bgs) down to below the bottom of the excavation (approximately 14 ft) and appeared to be most prevalent on the west edge of the trench.

The physical boundary for CPP-37B, shown in the ROD, was based on historical knowledge, the 1980 topographical survey (GAI 1992), and the 1991 geophysical survey. Discovery of the debris adjacent to the CPP-37B site in November 2000 led to further investigation. After reviewing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documents and aerial photos, it was determined that the CPP-37B boundary identified in the ROD did not accurately reflect the full extent of the debris pit that was used for disposal. Rather than expand the boundaries of the CPP-37B site to include the full extent of the debris pit, a new site, CPP-37C, was established to encompass the remaining extent of the debris pit.

The physical boundaries for Site CPP-37C were defined through the use of aerial photos and topographical surveys. The INL Site aerial photographs indicated that the CPP-37C site boundary is bounded on the east by the East Perimeter Road, on the south by the internal INTEC access roadway system, on the west by CPP-37B, and on the north by CPP-37B northern limits.

Site CPP-37C is introduced in the RD/RAWP as belonging to OU 3-13, Group 3, Remediation Set 2, as is CPP-37B. They are described as

- CPP-37B – Gravel pit and debris landfill inside INTEC fence

- CPP-37C – New site contamination area southeast of CPP-37B.

Their relative locations within INTEC are shown in Figure 1-1.

Section 5.1.1.6 of the RD/RAWP states the following for CPP-37C:

> There are insufficient data or process knowledge for Site CPP-37C to define the extent of contamination or determine whether RGs are exceeded. Therefore, characterization data are needed to determine if remediation of this site is necessary.

This is expanded in Section 5.1.3 (of the RD/RAWP) to include the following:

> The lateral extent of soil contamination is defined by physical boundaries for several sites (e.g., the boxed soil sites, CPP-97, CPP-03, CPP-67, and CPP-34A/B) and by existing sampling data for others (e.g., CPP-37A and 37B). The lateral and vertical extent of soil contamination at Site CPP-37C, however, is undefined. Additionally, the suspected presence of contaminated debris at CPP-37B and 37C is unconfirmed.

The combined summary statements from the ROD and RD/RAWP mandated that further characterization sampling be conducted throughout the CPP-37B and CPP-37C sites before a decision could be made regarding the need for remediation. The Characterization Plan (DOE-ID 2005) was subsequently developed to guide the sampling and characterization activities.

The Characterization Plan reiterated the need for further sampling in Sites CPP-37B and CPP-37C and expressed Decision Statement 1 (in Section 3.7.1) as a need to determine if remediation at the sites was necessary. The Characterization Plan then developed a site-specific sampling design strategy for both sites and the necessary data analyses required to satisfy Decision Statement 1. Elements of the Characterization Plan are discussed further in subsequent sections of this report.

Figure 1-1. Location of the OU 3-13 Sites CPP-37B and CPP-37C within INTEC.

1.3 Scope

The scope of this report is to

- Present characterization sampling data for Sites CPP-37B and CPP-37C

- Summarize the characterization sampling and data analyses results

- Recommend a path forward that will satisfy the requirements for remediation established in the ROD.

The characterization sampling results are presented and discussed for those nine contaminants of concern (COCs) identified in the ROD, specifically for OU 3-13, Other Soil Sites, and in the Characterization Plan. These are presented in Table 1-1 and discussed further in Section 4.

Table 1-1. Operable Unit 3-13 soil remediation goals.

Contaminant of Concern	Soil Risk-Based Remediation Goal[a] for Single COCs[b]
Hg	23 mg/kg
Am-241	290 pCi/g
Cs-137	23 pCi/g
Eu-152	270 pCi/g
Eu-154	5,200 pCi/g
Pu-238	670 pCi/g
Pu-239/240	250 pCi/g
Pu-241	56,000 pCi/g
Sr-90	223 pCi/g

a. Source of the risk-based remediation goals is Table 8-1 of the OU 3-13 ROD (DOE-ID 1999).
b. If multiple contaminants are present, use sum of the fractions to determine the combined COC remediation goal.

2. CHARACTERIZATION SAMPLING

The RD/RAWP (DOE-ID 2004) specified in Section 5.1.3 that the Characterization Plan would present a three-phased sampling approach to define the extent of contamination for sites CPP-37B and CPP-37C. The first phase would consist of a geophysical survey (ground-penetrating radar) conducted to look for disturbed areas and buried objects (e.g., debris at CPP-37B and CPP-37C) and to better define the lateral boundaries of Site CPP-37C. Sampling would be performed in the second phase, with sample locations selected based on the results of the geophysical surveys. The sample locations would be biased to avoid boring into debris or sampling in areas where sufficient data already exist. The third phase would be the excavation of test pits/trenches in areas where the geophysical survey results indicate the possible presence of debris. These test areas would be excavated to no greater than 10 ft below grade (the lateral dimensions would be determined based on the survey results), and the debris would be extracted and analyzed using gamma spectroscopy to determine its disposition.

The RD/RAWP also initially specified in Section 5.2.1, the design excavation depths for each of the OU 3-13 sites. The design excavation depths were based on the compilation and review of existing data for each site. The depth to which a site would be excavated was determined by selecting the depth at each site where all detected soil COCs were below the remediation goals (RGs). Where data were available at multiple depths for a given site, the excavation depth was determined by selecting the first sampled depth where all COCs were below the RGs. Table 2-1 presents information extracted from Table 5-1 in the RD/RAWP regarding the design excavation depth and its basis for Sites CPP-37B and CPP-37C.

Table 2-1. Design excavation depths for sites CPP-37B and CPP-37C (condensed from Table 5-1 of the RD/RAWP).

Site	Design Excavation Depth (ft)	Comments
CPP-37B	To be determined	No COCs > RGs at any sampled depth. If characterization sampling verifies no COCs >RGs, then no remediation required for this site.
CPP-37C	To be determined	No COCs > RGs for any samples. If additional characterization sampling verifies no COCs > RGs, then no remediation required for this site.

2.1 Phase 1: CPP-37B and CPP-37C Geophysical Survey

A geophysical survey of the CPP-37B and CPP-37C area was conducted to determine the boundaries of the site, determine the extent and locations of debris and utilities, and confirm the pit edges (based upon material density variations). The boundary previously established for Site CPP-37C was based on historical photographic evidence of waste pits in the area. A ground-penetrating radar system was used to locate buried debris, structures, and utilities, as specified in the RD/RAWP; however, the resolution and accuracy of the system were inadequate for defining the site boundaries and biased sampling locations. A time-domain metal detector (Geonics Limited, model EM61-MK2) was subsequently used to gather more-useful data regarding the underground structure of the sites.

The EM61-MK2 uses a technique called time-domain electromagnetic induction (TDEMI) which directs a pulsed electromagnetic field into the ground, whereupon, small electric eddy currents are induced in the surface and subsurface structures. The electric currents and associated electromagnetic fields they generate decay as a function of time and composition of the responding materials. The EM61-MK2 detects the decaying fields and stores the intensity data as a function of decay time. A computer-generated image of the data, using different colors to represent different electromagnetic field/time-domain composites, revealed a subsurface structural map that was used to identify locations of debris, types of debris, and utilities. Figure 2-1 shows a composite map of several scans over the CPP-37B and CPP-37C sites taken prior to conducting the characterization sampling.

2.2   Phase 2: CPP-37B and CPP-37C Borehole Characterization Sampling

A 140.0-ft grid system was established over the CPP-37B and CPP-37C sites for accurate identification of the sampling locations. Then, six biased sample locations were selected at CPP-37B and samples collected from various depths, ranging to 35 ft below ground surface (bgs), based upon previous sampling depths, historical photos of the waste pit, and historical survey data of waste pit depths. The number of sample locations was selected to supplement the sampling conducted at this site during the Track 2 investigation (LITCO 1995). The locations were biased to avoid boring into debris and utilities. Figure 2-2 shows the sampling locations for CPP-37B. Core samples from 0.0 to approximately 10.0 ft bgs were composited to form single samples representative of the depth range of 0-10.0 ft for each borehole. Core samples ranging from 10 ft bgs to 35.0 ft bgs (or to refusal) were composited to form representative single samples of the depth range of 10.0-35.0 ft for each borehole.

Eleven biased locations were selected and sampled from inside the CPP-37C site boundary. Samples were collected from various depths, ranging to 20 ft bgs, based upon the results of the geophysical survey, historical photos, and historical survey data. Figure 2-2 shows the sampling locations for CPP-37C. Samples from 0.0 to approximately 10.0 ft bgs were composited to form samples representative of the depth range of 0-10.0 ft for each borehole. Core samples collected from 10.0 ft bgs through 20.0 ft bgs were composited to form representative samples of the depth range of 10.0-20.0 ft for each borehole. All characterization samples for the CPP-37B and CPP-37C sites were collected in accordance with the Characterization Plan (DOE-ID 2005). Table 2-2 presents geographical survey data where the samples were collected and the actual depths used to make the composite samples.
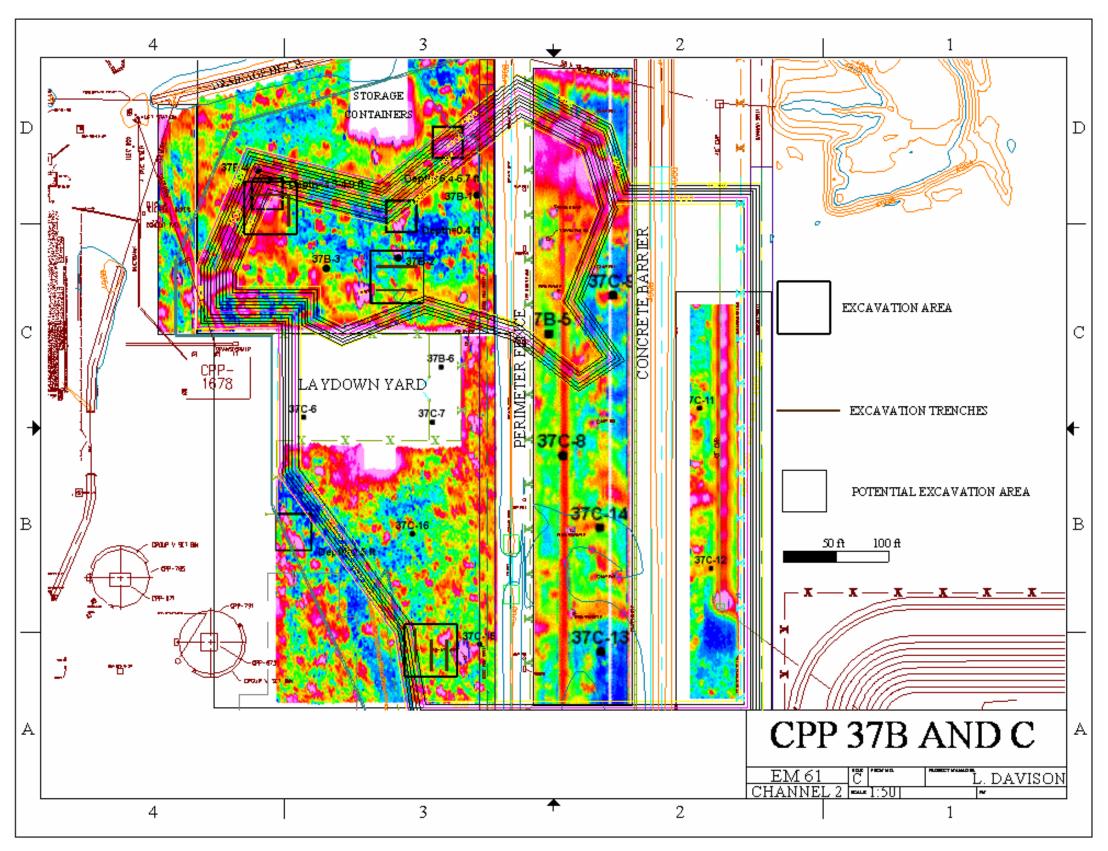
Figure 2-1. CPP-37B and CPP-37C subsurface representation obtained using time-domain electromagnetic induction techniques.
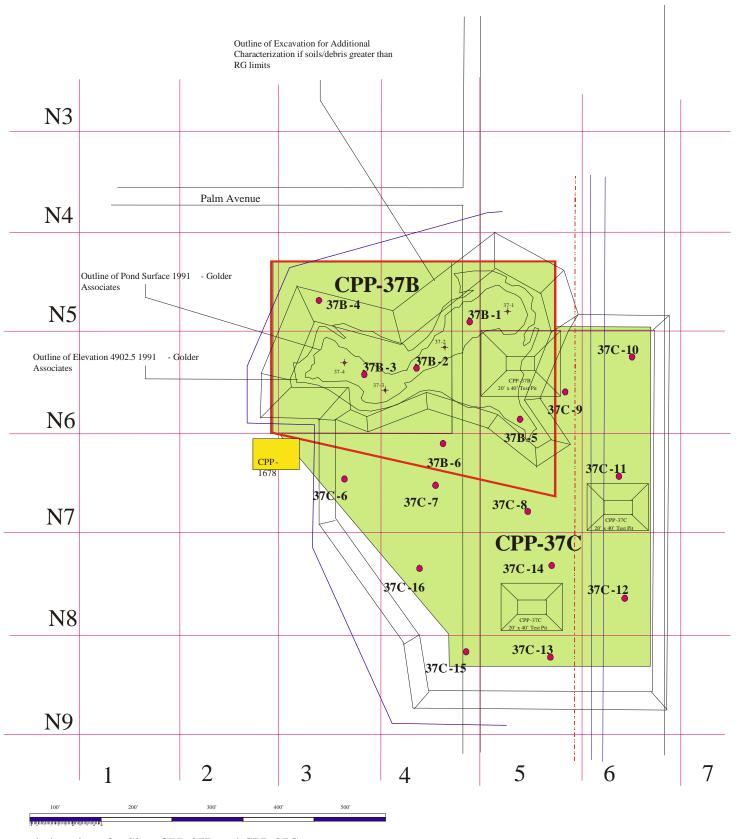
Figure 2-2. Characterization sample locations for Sites CPP-37B and CPP-37C.

The following labels and annotations appear on the figure:

Grid labels (vertical axis): N3, N4, N5, N6, N7, N8, N9
Grid labels (horizontal axis): 1, 2, 3, 4, 5, 6, 7

Outline of Excavation for Additional Characterization if soils/debris greater than RG limits

Palm Avenue

Outline of Pond Surface 1991 - Golder Associates

Outline of Elevation 4902.5 1991 - Golder Associates

CPP-37B
37B-4
37B-1
37-1
37-2
37B-3
37B-2
37-4
37-3
CPP-37B 20' x 40' Test Pit
37B-5
37B-6

CPP-1678

CPP-37C
37C-10
37C-9
37C-11
CPP-37C 20' x 40' Test Pit
37C-6
37C-7
37C-8
37C-14
37C-16
37C-12
CPP-37C 20' x 40' Test Pit
37C-13
37C-15

Scale: 100' 200' 300' 400' 500'

Grid Established per the Site Surface Exposure Area (EA) Limit
Less than 0. 5 acres or 146 lf x 146 lf ==> 140 lf Grid Used

Borehole Locations are Based Upon BIASED Placement to Define the Boundary of the CPP -37C Burial

Proposed Additional Characterization Sampling:
Previous Borehole Location   - within old Pond Location
37-1 / 37 -2 / 37 -3 / 37 -4 ==> Golder Associates 1991

CPP -37B Site Sampling Boreholes
Recommended   Sampling Depths
 2.0 lf / 5.0 lf / 10.0 lf / 15.0 lf / 20.0 lf / 25.0 lf / 30.0 lf / 35.0 lf
Interior Boundary Samples
Biased - Located between previous samples
 37B -1 / 37B -2 / 37B -3
Biased - Located outside pond area
 37B -4 / 37B -5 / 37B -6

CPP -37C Site Sampling Boreholes
Recommended   Sampling Depths
 2.0 lf / 5.0 lf / 10.0 lf / 15.0 lf / 20.0 lf
Exterior Boundary Samples
 Not Required due to "Known" Boundary of Landfill from Aerial Photo
Interior Boundary Samples
 37C -6 / 37C -7 / 37C -8 / 37C -9 / 37C -10 / 37C -11
 37C -12 / 37C -13 / 37C -14 / 37C -15 / 37C -16

ROD Recognized these Sites as "LANDFILLS"
Recommended Approach Sequencing
 - Geophysical Surveys (Rapid Ground Penetrating Radar Mapping)
 - Location of Biased Boreholes
 - "Test Trenches / Pits"
   Test Trenches 20'0" wi   de at bottom with variable lengths
    [25'0" depth] - Slopes 1.5:1 ==> Top 100'0" wide
    [15'0" depth] - Slopes 1.5:1 ==> Top 65'0" wide
    [10'0" depth] - Slopes 1.5:1 ==> Top 50'0" wide
NOTE:
 - Typic al Test Trench / Pit configurations are shown on drawing for graphical
 - Typical Trench / Pit depth   - Minimum of 6'0" Maximum of 10'0"

Table 2-2. Characterization sampling borehole location and sampling depth for Sites CPP-37B and CPP-37C.

Borehole Sampling Identifiers		Geophysical Survey Coordinates		Date Started/ Completed	Refusal Depth (ft)	Sample Interval (ft)	Comments
Borehole ID	Borehole	Northing	Easting				
37B-1	A	695,948	297,844	10/04/05	9	0-9	Undetermined
	B	695,942	297,842	10/04/05	33	10-33	Basalt
37B-2	A	695,888	297,779	10/03/05	7	0-7	Concrete
	B	695,888	297,785	10/03/05	7.5	Abandoned	Concrete
	C	695,896	297,787	10/10/05	33	10-33	Basalt
37B-3	A	695,879	297,707	10/03/05	14	0-10	Concrete
	B	695,882	297,710	10/03/05	35	10-35	No refusal
37B-4	A	695,973	297,644	10/03/05	4	Abandoned	Concrete
	B	695,973	297,640	10/03/05	4.5	0-4.5	Concrete
	C	695,983	297,664	10/10/05	3.5	Abandoned	Concrete
	D	695,983	297,624	10/10/05	5	Abandoned	Concrete
37B-5	A	695,825	297,927	10/05/05	8	Abandoned	Concrete
	B	695,827	297,928	10/06/05	10	0-10	Concrete
	C	695,821	297,928	10/06/05	8	Abandoned	Concrete
	D	695,817	297,920	10/06/05	10	Abandoned	Concrete
	E	695,857	297,952	10/11/05	33	10-33	Basalt
37B-6	A	695,791	297,817	09/25/05	35	0-10 & 10-35	No refusal
37C-6	A	695,744	297,684	09/28/05	20	0-10 & 10-20	No refusal
37C-7	A	695,739	297,808	09/29/05	20	0-10 & 10-20	No refusal
37C-8	A	695,708	297,938	10/05/05	11	0-10	Basalt cobbles
	B	695,702	297,938	10/05/05	11	Abandoned	Basalt cobbles
	C	695,708	297,944	10/05/05	20	10-20	No refusal
37C-9	A	695,862	297,981	10/04/05	2.5	Abandoned	Undetermined
	B	695,868	297,981	10/04/05 10/05/05	20	0-10 & 10-20	No refusal
37C-10	A	695,909	298,071	10/11/05	20	0-10 & 10-20	No refusal
37C-11	A	695,757	298,057	10/12/05	20	0-10 & 10-20	No refusal
37C-12	A	695,595	298,064	10/12/05	20	0-10 & 10-20	No refusal
37C-13	A	695,521	297,970	10/05/05	20	0-10 & 10-20	No refusal
37C-14	A	695,639	297,969	10/05/05	14.5	0-10	Basalt cobbles
	B	695,645	297,969	10/05/05	20	10-20	No refusal
37C-15	A	695,525	297,857	10/04/05	20	0-10 & 10-20	No refusal
37C-16	A	695,632	297,789	10/04/05	20	0-10 & 10-20	No refusal

2.3   Phase 3: Excavation of Test Pit/Trenches

During the October/November 2005 timeframe when the borehole samples were being collected, test pits/trenches were also dug to extract buried debris for radiological field screening, as specified in the RD/RAWP. Two pit locations in CPP-37B (Pits 37B-1 and 37B-2) and one pit location in CPP-37C (Pit 37C-1) were identified for excavation. The locations were chosen after analysis of the TDEMI data to reflect areas containing relatively higher densities of debris. The three pit areas were approximately 20 ft square; however, not all of the area was excavated. Rather, 2-ft-wide, 10-ft-deep trenches were dug in each pit using a commercial backhoe with a 2-ft-wide bucket. The pit areas and location of the trenches excavated are shown in Figure 2-1. Photographs of the excavations are presented in Appendix A. The trenches dug are described below:

- Pit 37B-1 trenches. Two trenches were dug in the area. One trench ran east-to-west along the northern end of the pit area. A second trench was dug running north-to-south along the western end of the pit area.

- Pit 37B-2 trenches. Two trenches were dug in the area. Both trenches ran east-to-west through the pit area, bisecting the pit area into approximate thirds.

- Pit 37C-1 trenches. Three trenches were dug through the area. All three trenches ran north-to-south, the length of the pit area, and bisected the pit area into approximate quarters.

The pit areas were scanned prior to sampling and excavation, using gamma spectroscopy, which incorporated a high-purity germanium (HPGe) detector. This high-resolution, in situ germanium spectrometer field measurement system consisted of an HPGe detector mounted 1 m (3 ft) above the ground on a tripod and moved to different locations for scanning. A 1.0-in.-thick collimator was used to shield the detector from possible sources of shine, or background radiation, as necessary. Proper system operation was monitored throughout the fieldwork to ensure accuracy of the measurements. Radiological control technicians (RCTs) and a surveyor/health physicist were present during the excavations to ensure safety for the excavation crew and provide rapid radiological assessment of all material excavated. The HPGe system was used during the excavation to monitor real-time radiation fields in the pit area and to characterize the excavated soil and debris for Cs-137 contamination, through its gamma emissions.

3. SAMPLE ANALYSES, DATA MANAGEMENT, AND QUALITY CONTROL

3.1 Phase 1: Geophysical Survey

The geophysical survey was conducted by personnel having certifications in surveying and health physics and expertise using TDEMI. The TDEMI data were gathered by moving the EM61-MK2 over the surface of the sites and electronically storing the soil-response data with an associated, precise geographic location, obtained through the use of a global positioning system (GPS) mounted on the instrument and electronically coupled to the data storage component.

The data from the four-channel analyzer were transformed into color-coded computer images by the instrument operators, who also assisted program personnel in their interpretation. Analysis of the data relies heavily on the skill of the operator for interpretation, as the technique does not lend itself to calibration. Conductivity of the soil being scanned (and to which the instrument is sensitive) varies in a manner that cannot be predetermined according to its composition, density, water content, etc., precluding the use of standards. Due to the qualitative nature and intended use of the results, no quality requirements were imposed on the data or the instrumentation, other than checking to ensure the instrument was functioning properly according to the manufacturer's specifications.

The TDEMI information was used for three purposes, as outlined below:

1. To verify that the physical boundaries on the surface encompassed the entire pit area

2. To determine locations of subsurface debris in relatively higher concentrations, so those areas could be excavated and debris brought up for radiologic analyses

3. To identify and exclude the immediate areas having existing utilities (steam lines, electrical lines, etc.) from excavation and borehole sampling.

3.2 Phase 2: Borehole Samples

Characterization samples collected from the boreholes were analyzed at either an off-Site contract analytical laboratory or on the INL Site at the analytical laboratory located at INTEC. The data quality objects and acceptable analytical procedures were specified in the CP, along with packaging, handling, shipping, and hold time requirements. The data packages provided by the analytical laboratories were reviewed independently by another off-Site contractor, who subsequently provided limitations and validation (L&V) reports. The sum of data was transmitted to the Agencies (the Environmental Protection Agency and the Idaho Department of Environmental Quality) in nine separate L&V report transmittals.

3.3 Phase 3: Test Pit/Trenches

Soil and debris dug up during the trench excavations were surveyed on the sites using portable contamination monitoring equipment, as specified in the health and safety plan (INEEL 2005) to minimize radiation exposure to workers. Multiple instruments capable of measuring alpha or beta-gamma radiation, respectively, were used. The instruments were calibrated at the Health Physics Laboratory each day before use. Continuous air monitoring instruments were also positioned around the sites to detect possible releases of airborne contamination during the excavations.

Soil and debris dug up during the trench excavations were also subjected to field-portable in situ gamma spectroscopy using HPGe detectors. This was conducted with two objectives. The first objective was to determine the radioactivity of the soil samples that were to be shipped to laboratories for analyses. This was necessary to ensure proper sample packaging, handling, and shipping, for which the requirements are specific to the radioisotope composition, concentration, and field generated around the samples. Composite soil samples (pucks) were made from lengths of cored soil, mixed to ensure representativeness, and placed in sample holders for field analyses. The samples were analyzed by placing them flush against a collimated tube leading into the gamma spectrometer. This technique eliminated background effects and provided accurate measurements. The HPGe gamma spectrometer was calibrated in the field alongside of the samples using a standard K-40 source to measure and compare instrument response between the samples and standard.

The second objective was to determine if individual pieces of debris, that might otherwise go undetermined by just sampling the soil, exceeded the RGs. Pieces of concrete, basalt, wood, and metal were individually analyzed in a similar manner to that used for the soil samples, except they were not placed in sample containers. Rather, the instrument was brought up against the debris where it rested, and the measurements taken. Table 3-1 (summarized from Section 3.8 of the Characterization Plan) shows the performance requirement criteria for these measurements (borehole soil samples and debris), which, upon satisfying, are sufficient to resolve Decision Statement 1.

Table 3-1. Analytical performance requirements for the Operable Unit 3-13, Group 3, sites.

Analyte	Survey/Analytical Method	Preliminary Action Level	Practical Quantitation Limit	Precision Requirement	Accuracy Requirement
Gamma emitters	Gamma survey	≥5 mrem/hr	See RadCon Manual[a]	See RadCon Manual[a]	See RadCon Manual[a]
	Gamma spectroscopy	≥23 pCi/g	0.1 pCi/g	±20%	80–120%
Alpha emitters	Alpha spectroscopy	Refer to disposal site WAC[b]	QAPjP[c]	±30%	70–130%
Beta emitters	Liquid scintillation and/or gas flow proportional counting	Refer to disposal site WAC[b]	QAPjP[c]	±30%	70–130%

a. PRD-183, 2005, "Radiological Control Manual," Rev. 8, Idaho Completion Project, Idaho National Laboratory, March 2005.
b. Waste Acceptance Criteria.
c. DOE-ID, 2004, *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10 and Deactivation, Decontamination, and Decommissioning*, DOE/ID-10587, Rev. 8, U.S. Department of Energy Idaho Operations Office, March 2004.

4.   DATA SUMMARY FOR SITES CPP-37B AND CPP-37C

4.1   Phase 1: Subsurface Structural Data

The subsurface structural data gathered from the TDEMI evaluation are not presented here. The qualitative features resulting from the computer-generated image were presented earlier in Figure 2-1 and are discussed briefly in this section for completeness. It is necessary to have a colored image to interpret the results. Generally speaking, seven colors are used to represent significant differences in the composition of the pit: green, yellow, orange, light blue, dark blue, pink, and red. For qualitative purposes, the orange, pink and red colors represent increasing density of foreign material in the soil, respectively.

The TDEMI instrument has limited capability to resolve the depth profile of buried objects. In general, the depth of debris represented in the image (Figure 2-1) may range from surface to ca. 15 ft bgs. The image was compared against existing facility drawings and visual identification of surface structures and debris, to develop a qualitative understanding of the subsurface distribution of foreign material. The main objectives accomplished through this exercise are outlined below:

1.   The TDEMI image confirmed that the surface boundaries did encompass the entire pit area.

2.   Three areas were located over the sites representing relatively higher concentrations of buried debris; these areas were chosen for excavation. The three areas chosen for the trenching excavations were approximately 20 ft square. Two areas were in CPP-37B and one area in CPP-37C.

3.   Accurate positions of subsurface utilities were determined and borehole sampling and trenching locations were adjusted to not compromise the utilities.

4.2   Phase 2: Characterization Sampling Results for Composited Borehole Samples

The analytical data from the composited borehole samples collected from Sites CPP-37B and CPP-37C are summarized in Tables 4-1 and 4-2. The data used for the calculations, the methods used for calculating the statistics, and the results are presented in Appendix B.

The 36 sets of analytical data (for the samples collected on CPP-37B at 0-10 ft and 10-35 ft and CPP-37C at 0-10 ft and 10-20 ft, and analyzed for nine COCs) were tested for normality. The data sets were determined to follow (1) a normal distribution, (2) a log-normal distribution, or (3) no assumed distribution. The Shapiro-Wilk test for normality was used to evaluate each set of data, as specified in the CP. The results, summarized in Tables 4-1 and 4-2, present the COCs in the first column, followed by the assumed distribution in the second column. Subsequent columns report the average values, maximum values, and the RGs specified in the ROD. The values were compared in the following manner:

- Data following a normal distribution – The raw data were used to calculate the mean, standard deviation, and the 95% UCL, which was compared to the RG.

- Data following a log-normal distribution – The natural log-transformed data were used to calculate the mean, standard deviation, and the 95% UCL, which was compared to the natural log-transformed RG.

- Data with no assumed distribution – The maximum observed sample concentration/activity was compared to the RG.

Table 4-1. Summary of characterization sampling data from Site CPP-37B.

Contaminant of Concern	Assumed Distribution of Data	CPP-37B Concentration/ Activity (95% UCL)	CPP-37B, Maximum Sample Concentration/Activity	ROD RG
-head	Results for sampling in the depth range 0 to 10 ft bgs			
Hg	None	0.05 mg/kg	0.05 mg/kg	23 mg/kg
Am-241	Log-normal	1.02 ln(pCi/g)	5.94 pCi/g	290 pCi/g 5.67 ln(pCi/g)
Cs-137	Log-normal	1.18 ln(pCi/g)	7.26 pCi/g	23 pCi/g 3.14 ln(pCi/g)
Eu-152	Normal	0.005 pCi/g	0.03 pCi/g	270 pCi/g
Eu-154	Normal	0.04 pCi/g	0.07 pCi/g	5,200 pCi/g
Pu-238	Normal	0.43 pCi/g	0.61 pCi/g	670 pCi/g
Pu-239/240	Normal	0.40 pCi/g	0.46 pCi/g	250 pCi/g
Pu-241	Log-normal	4.72 ln(pCi/g)	241 pCi/g	56,000 pCi/g 10.9 ln(Ci/g)
Sr-90	None	1.84 pCi/g	1.84 pCi/g	223 pCi/g
-head	Results for sampling in the depth range 10 bgs to 35 ft bgs			
Hg	Normal	0.05 mg/kg	0.06 mg/kg	23 mg/kg
Am-241	Normal	0.38 pCi/g	0.52 pCi/g	290 pCi/g
Cs-137	Normal	0.78 pCi/g	0.89 pCi/g	23 pCi/g
Eu-152	Normal	0.13 pCi/g	0.20 pCi/g	270 pCi/g
Eu-154	Normal	0.08 pCi/g	0.10 pCi/g	5,200 pCi/g
Pu-238	None	0.55 pCi/g	0.55 pCi/g	670 pCi/g
Pu-239/240	Normal	0.29 pCi/g	0.30 pCi/g	250 pCi/g
Pu-241	Normal	14.4 pCi/g	20.9 pCi/g	56,000 pCi/g
Sr-90	None	4.15 pCi/g	4.15 pCi/g	223 pCi/g

Table 4-2. Summary of characterization sampling data from Site CPP-37C.

Contaminant of Concern	Assumed Distribution of Data	CPP-37C Concentration/ Activity (95% UCL)	CPP-37C, Maximum Sample Concentration/Activity	ROD RG
Results for sampling in the depth range 0 to 10 ft bgs				
Hg	Normal	0.04 mg/kg	0.05 mg/kg	23 mg/kg
Am-241	Normal	0.55 pCi/g	0.95 pCi/g	290 pCi/g
Cs-137	Normal	2.17 pCi/g	3.62 pCi/g	23 pCi/g
Eu-152	None	0.07 pCi/g	0.07 pCi/g	270 pCi/g
Eu-154	Normal	0.05 pCi/g	0.08 pCi/g	5,200 pCi/g
Pu-238	Normal	0.39 pCi/g	0.55 pCi/g	670 pCi/g
Pu-239/240	None	0.60 pCi/g	0.60 pCi/g	250 pCi/g
Pu-241	Normal	22.4 pCi/g	38.3 pCi/g	56,000 pCi/g
Sr-90	Log-normal	0.26 ln(pCi/g)	4.63 pCi/g	223 pCi/g 5.41 ln(pCi/g)
Results for sampling in the depth range 10 bgs to 20 ft bgs				
Hg	normal	0.03 mg/kg	0.04 mg/kg	23 mg/kg
Am-241	Log-normal	-0.365 ln(pCi/g)	1.59 pCi/g	290 pCi/g 5.67 ln(pCi/g)
Cs-137	Log-normal	-2.23 ln(pCi/g)	3.69 pCi/g	23 pCi/g 3.14 ln(pCi/g)
Eu-152	None	0.19 pCi/g	0.19 pCi/g	270 pCi/g
Eu-154	Normal	0.04 pCi/g	0.13 pCi/g	5,200 pCi/g
Pu-238	None	2.50 pCi/g	2.50 pCi/g	670 pCi/g
Pu-239/240	None	0.85 pCi/g	2.48 pCi/g	250 pCi/g
Pu-241	Log-normal	3.34 ln(pCi/g)	64.4 pCi/g	56,000 pCi/g 10.9 ln(pCi/g)
Sr-90	None	18.6 pCi/g	18.6 pCi/g	223 pCi/g

4.3 Phase 3: Real-Time Analyses of Soil and Debris Exposed During the Trench Excavations

Gamma scans were collected on debris brought to the surface during excavation of the trenches in Pits 37B-1, 37B-2, and 37C-1. The gamma-scan data are shown in Table 4-3. The K-40 entries represent the instrument response for the standard (K-40) used in the field to ensure accurate response from the instrument.

Table 4-3. Radiologic data collected for excavated debris during characterization sampling of Sites CPP-37B&C.

Sample ID	Cs-137 (pCi/g)	2 Sigma (pCi/g)	K-40 (pCi/g)	2 Sigma (pCi/g)	Contents
Basalt	0.3	0.1	6.2	0.5	North trench
37-B-debris	0.7	0.1	9.3	0.6	Middle trench (wood, basalt)
37-C-bag	0.5	0.1	11	0.6	South trench (soil, wood)

5.   SUMMARY AND CONCLUSIONS

Characterization sampling was conducted throughout Sites CPP-37B and CPP-37C to address Decision Statement 1, paraphrased from the Characterization Plan as

> Do these sites have at least one COC in the soil having a mean concentration (at 95% UCL) greater than the respective RG?

Information in this report substantiates that these sites (CPP-37B and CPP-37C) do not require remediation, because the concentrations of COCs are substantially lower than the RGs specified in the ROD for OU 3-13 sites.

5.1   Phase 1: Conclusions Regarding the Subsurface Structure of Sites CPP-37B and CPP-37C

Several qualitative features of the subsurface structure of the CPP-37B and CPP-37C sites were revealed using TDEMI instrumentation. The computer-generated image was used to map debris and utility positions. Debris was observed in unspecified depths in the range 0 to 15 ft bgs (the maximum depth of penetration for the instrument).

Subsurface mapping of the CPP-37B and CPP-37C sites revealed that the physical surface boundaries (fences, roads, etc.) encompassed the entirety of the existing debris pit, as described in the ROD (CPP-37B) and expanded in the RD/RAWP (CPP-37B and CPP-37C). This addresses the implied condition of Decision Statement 1, that sampling be conducted in a representative area. Consequently, the subsequent sampling and trenching efforts were conducted in the pit area and the samples are representative of the contents of the pit.

5.2   Phase 2: Conclusions Regarding the Characterization Sampling Results for Composited Borehole Samples Collected from Sites CPP-37B and CPP-37C

The analytical data from the composited borehole samples collected throughout Sites CPP-37B and CPP-37C, and summarized in Tables 4-1 and 4-2, show that the concentrations of COCs present in the sites are much less than the RGs established in the ROD. Thirty-six summary results for the average concentration/activity of nine COCs in two sites, at two depths (0-10 ft bgs and below 10 ft bgs) are presented. The RGs exceed the 95% UCL of each contaminant that follows a normal distribution, by one order of magnitude or greater. The natural log-transformed results for data following a log-normal distribution, similarly, were well below the natural log-transformed RGs. In addition, the maximum concentration/activity for all COCs was less than the respective RG.

This addresses and satisfies the specific condition of Decision Statement 1, that no COC in the soil has a mean concentration (at the 95% UCL) greater than the respective RG. Further, no single maximum concentration/activity determined in the samples for any COC exceeds the RG.

5.3   Phase 3: Conclusions Regarding the Real-Time Analyses of Soil and Debris Exposed During the Trench Excavations on Sites CPP-37B and CPP-37C

Trenches were excavated in three areas (two pit areas [three trenches]) in CPP-37B and one pit area ([three trenches] in CPP-37C) having relatively higher concentrations of debris. Excavated debris was subjected to in-the-field gamma spectroscopy and other hand-held radiological measurement devices to evaluate the contamination of buried debris. The gamma spectroscopy using HPGe detectors was specifically sensitive to Cs-137 activity. All debris excavated and evaluated using the HPGe system had Cs-137 contamination greater than one order of magnitude less than the RG.

This addresses and satisfies another implied condition of Decision Statement 1, that no debris buried in Sites CPP-37B and CPP-37C have levels of radionuclide contamination that would necessitate removal due to potential risk to human health or the environment.

6.   RECOMMENDATIONS

The COCs contained in the CPP-37B and CPP-37C sites are well below action levels, supporting a determination that these sites be considered "no action" sites. Both sites are currently under institutional control under the larger guidance of the institutional controls applied to the INTEC site, while undergoing remedial action activities. They will remain under institutional control until a 5-year review and concurrence from the Agencies (the Environmental Protection Agency, Idaho Department of Environmental Quality, and DOE) indicate they can be released for unrestricted use.

7. REFERENCES

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Appendix A

Photographs of the CPP-37B and CPP-37C Trench Excavations

APPENDIX A

Photographs of the CPP-37B and CPP-37C Trench Excavations

Figure A-1. Boring machine used at Sites CPP-37B and CPP-37C.

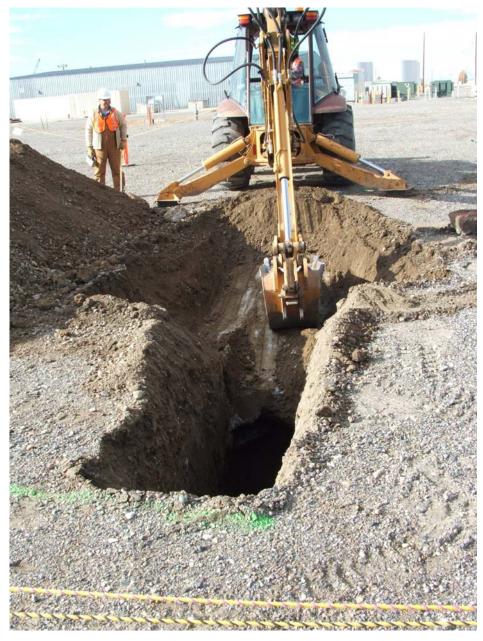Figure A-2. Borehole position for CPP-37B-1 being marked.

Figure A-3. Trenching at the CPP-37B and CPP-37C sites (first photograph).

Figure A-4. Trenching at the CPP-37B and CPP-37C sites (second photograph).

Figure A-5. Debris brought to the surface during trench excavation at the CPP-37B and CPP-37C sites.

Figure A-6. CPP-37B and CPP-37C sites after trenches were backfilled.

Appendix B

**CPP-37B and CPP-37C
Data Used in the Statistical Evaluation**

Appendix B

CPP-37B and CPP-37C Data Used in the Statistical Evaluation

The data presented in this appendix and used in calculations were extracted from existing limitations and validation (L&V) reports previously submitted to the Agencies for review. They are referenced as notes in each of the data sets provided in the following tables. Much of the data is "qualified" and has a "flag" associated with it. The U and J flags are described in the L&V reports and refer to any of three conditions applying to the data which make it suspect. The three conditions are (1) the data have a negative value, (2) the data are within experimental error of zero, or (3) the data are reported at a level below the accepted minimum detectable concentration/activity. These conditions are a direct reflection of the COCs present at the CPP-37B and CPP-37C sites. In many instances, the samples contain such low concentrations of the COCs that their accurate determination is nearly impossible. On the other hand, the minimum acceptable detection limits specified in the L&V reports ensure that the data received are adequate to conduct the necessary statistical evaluation. As such, all of the data shown in the tables were used in the statistical evaluations, since none could be legitimately rejected. The qualifier flags are further described below:

No Flag   (nonradioactive analytes) - The analysis was performed and the analyte was detected [(statistically positive at the 95% confidence interval and is above the minimum detectable concentration (MDC)]. The analyte is considered to be present in the sample.

No Flag   (radionuclide analytes) - The analysis was performed and radioactivity was detected [(statistically positive at the 95% confidence interval and is above the minimum detectable activity (MDA)]. The radionuclide is considered to be present in the sample.

   U   The analysis was performed, the analyte was not detected (not statistically positive at the 95% confidence interval) and/or the result was < MDC or MDA, respectively. The analyte is not considered to be present in the sample.

   UJ   The analysis was performed. The result is highly questionable. The analyte may or may not be present in the sample.

   J   The analysis was performed and the analyte was detected. Result is statistically positive at the 95% confidence interval and is > MDC or MDA, respectively. Result is questionable. The analyte is considered to be in the sample; however, the result may not be accurate.

The standard deviation (*s*) was calculated according to

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}}$$

where

$x =$ sample value

$\bar{x} =$ sample average

$n =$ sample size.

The half-width of a confidence interval for the true mean (μ) at the 95% level was calculated according to

$$t_{0.95,n-1} \frac{s}{\sqrt{n}}$$

where the Student's t values (the 95th percentile of the distribution) depend on the confidence level and n, as shown below:

$t = 2.776$ for $n = 5$

$t = 2.571$ for $n = 6$

$t = 2.228$ for $n = 11$.

The 95% upper confidence limit (UCL) for the mean (μ) was calculated as

$$\text{UCL} = \bar{x} + t_{0.95,n-1} \frac{s}{\sqrt{n}}$$

All of the data sets were tested for normal and log-normal distribution using the Shapiro-Wilk test. All of the data, regardless of its distribution, were used to calculate the average, standard deviation, and the 95% UCL. Natural log transformations to the data were subsequently made if the data followed a log normal distribution. Data sets having Shapiro-Wilk p-values > 0.05 were assumed to follow a normal distribution, that is, the data were used without transformation. Data sets having Shapiro-Wilk p-values < 0.05 and a natural log-transformed Shapiro-Wilk p-value > 0.5 were assumed to follow a log-normal distribution. That is, the data were natural log-transformed. Data sets having Shapiro-Wilk p-values < 0.05 and ln Shapiro-Wilk p-values < 0.5 had no assumed distribution. In these cases, the maximum observed value is reported.

In each data set (two sets for each of the Tables B-1 through B-18), the values that are compared to RGs (or ln RGs) for the particular COC at that site are highlighted in the table. In following with the previous discussion, those highlighted values will correspond to a 95% UCL for normally distributed data, a log-transformed 95% UCL for log-normally distributed data, and a maximum value for data with no assumed distribution.

Table B-1. CPP-37B characterization sampling results for Hg for composited soil samples.

Location	Depth Represented by the Sample Composite	Sample Concentration[a,b] (mg/kg)	Natural Log-Transformed Sample Concentration[c] [ln(mg/kg)]	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	1.30E-02	-4.34E+00	UJ	3RA13001LA
37B-2	0 - 10 ft	1.30E-02	-4.34E+00	UJ	3RA13201LA
37B-3	0 - 10 ft	1.30E-02	-4.34E+00	UJ	3RA13401LA
37B-4	0 - 10 ft	1.40E-02	-4.27E+00	UJ	3RA13601LA
37B-5	0 - 10 ft	**4.50E-02**	-3.10E+00	U	3RA13801LA
37B-6	0 - 10 ft	2.00E-02	-3.91E+00		3RA14001LA
Statistical data (0-10 ft)					
Average Hg concentration		1.97E-02	--		
Sample standard deviation		1.27E-02	--		
95% upper confidence limit		2.97E-02	--		
Shapiro-Wilk p-value		0.001 (not normal)	0.006 (not log-normal)		
37B-1-Dup.	10 - 35 ft	1.40E-02	--	UJ	3RA13102LA
37B-2	10 - 35 ft	3.80E-02	--	U	3RA13301LA
37B-3	10 - 35 ft	1.40E-02	--	UJ	3RA13501LA
37B-5	10 - 35 ft	5.90E-02	--	U	3RA13901LA
37B-6	10 - 35 ft	1.30E-02	--	UJ	3RA14101LA
Statistical data (10-35 ft)					
Average Hg concentration		2.76E-02			
Sample standard deviation		2.05E-02			
95% upper confidence limit		**4.61E-02**			
Shapiro-Wilk p-value		0.065 (normal)			

a. L&V report DNT-010-06.
b. Bold values are the result compared to RGs. Maximum values are used for data with no assumed distribution.
c. -- represents values not reported.

Table B-2. CPP-37B characterization sampling results for Am-241 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[b,c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	2.55E+00	0.936		3RA13001RN
37B-2	0 - 10 ft	1.18E-02	-4.439	U	3RA13201RN
37B-3	0 - 10 ft	6.05E-01	-0.502	J	3RA13401RN
37B-4	0 - 10 ft	3.98E-01	-0.921	U	3RA13601RN
37B-5	0 - 10 ft	5.94E+00	1.782		3RA13801RN
37B-6	0 - 10 ft	3.99E-01	-0.919	U	3RA14001RN
Statistical data (0-10 ft)					
Average Am-241 activity		1.65	-0.68		
Sample standard deviation		2.09	2.14		
95% upper confidence limit		3.46	**1.02**		
Shapiro-Wilk p-value		0.021 (not normal)	0.406 (log-normal)		
37B-1-Dup.	10 - 35 ft	2.50E-01	--	U	3RA13102RN
37B-2	10 - 35 ft	0.00E+00	--	U	3RA13301RN
37B-3	10 - 35 ft	1.11E-01	--	U	3RA13501RN
37B-5	10 - 35 ft	5.17E-01	--	U	3RA13901RN
37B-6	10 - 35 ft	1.83E-01	--	U	3RA14101RN
Statistical data (10-35 ft)					
Average Am-241 activity		2.12E-01			
Sample standard deviation		1.94E-01			
95% upper confidence limit		**3.87E-01**			
Shapiro-Wilk p-value		0.705 (normal)			

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs.
c. -- represents values not reported.

Table B-3. CPP-37B characterization sampling results for Cs-137 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[b,c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	1.97E+00	0.678		3RA13001RN
37B-2	0 - 10 ft	3.45E-01	-1.064		3RA13201RN
37B-3	0 - 10 ft	8.84E-01	-0.123		3RA13401RN
37B-4	0 - 10 ft	2.36E+00	0.859		3RA13601RN
37B-5	0 - 10 ft	7.26E+00	1.982		3RA13801RN
37B-6	0 - 10 ft	7.26E-01	-0.320		3RA14001RN
Statistical data (0-10 ft)					
Average Cs-137 activity		2.26E+00	0.335		
Sample standard deviation		2.57E+00	1.068		
95% upper confidence limit		4.30E+00	**1.18**		
Shapiro-Wilk p-value		0.024 (not normal)	0.936 (log-normal)		
37B-1	10 - 35 ft	4.59E-01	--		3RA13101RN
37B-2	10 - 35 ft	4.10E-01	--		3RA13301RN
37B-3	10 - 35 ft	7.10E-01	--		3RA13501RN
37B-5	10 - 35 ft	1.46E-01	--		3RA13901RN
37B-6	10 - 35 ft	8.87E-01	--		3RA14101RN
Statistical data (10-35 ft)					
Average Cs-137 activity		5.22E-01			
Sample standard deviation		2.86E-01			
95% upper confidence limit		**7.80E-01**			
Shapiro-Wilk p-value		0.921 (normal)			
a. L&V report SOS-TL009-06. b. Bold values are the result compared to RGs. c. -- represents values not reported.					

Table B-4. CPP-37B characterization sampling results for Eu-152 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	1.69E-04	U	3RA13001RN
37B-2	0 - 10 ft	-3.32E-02	U	3RA13201RN
37B-3	0 - 10 ft	-8.36E-03	U	3RA13401RN
37B-4	0 - 10 ft	-4.75E-02	U	3RA13601RN
37B-5	0 - 10 ft	2.52E-02	U	3RA13801RN
37B-6	0 - 10 ft	-6.44E-02	U	3RA14001RN
Statistical data (0-10 ft)				
Average Eu-152 activity		-2.13E-02		
Sample standard deviation		3.31E-02		
95% upper confidence limit		**4.91E-03**		
Shapiro-Wilk p-value		0.941 (normal)		
37B-1	10 - 35 ft	2.00E-01	U	3RA13102RN
37B-2	10 - 35 ft	5.00E-02	U	3RA13301RN
37B-3	10 - 35 ft	-4.92E-02	U	3RA13501RN
37B-5	10 - 35 ft	1.50E-02	U	3RA13901RN
37B-6	10 - 35 ft	2.57E-02	U	3RA14101RN
Statistical data (10-35 ft)				
Average Eu-152 activity		4.83E-02		
Sample standard deviation		8.37E-02		
95% upper confidence limit		**1.32E-01**		
Shapiro-Wilk p-value		0.345 (normal)		
a. L&V report SOS-TL009-06. b. Bold values are the result compared to RGs.				

Table B-5. CPP-37B characterization sampling results for Eu-154 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	-1.17E-01	U	3RA13001RN
37B-2	0 - 10 ft	-2.38E-02	U	3RA13201RN
37B-3	0 - 10 ft	3.97E-02	U	3RA13401RN
37B-4	0 - 10 ft	6.72E-02	U	3RA13601RN
37B-5	0 - 10 ft	1.72E-02	U	3RA13801RN
37B-6	0 - 10 ft	-6.46E-02	U	3RA14001RN
Statistical data (0-10 ft)				
Average Eu-154 activity		-1.36E-02		
Sample standard deviation		6.89E-02		
95% upper confidence limit		**4.11E-02**		
Shapiro-Wilk p-value		0.862 (normal)		
37B-1	10 - 35 ft	1.02E-01	U	3RA13101RN
37B-2	10 - 35 ft	-2.05E-02	U	3RA13301RN
37B-3	10 - 35 ft	1.04E-02	U	3RA13501RN
37B-5	10 - 35 ft	-1.65E-03	U	3RA13901RN
37B-6	10 - 35 ft	7.97E-02	U	3RA14101RN
Statistical data (10-35 ft)				
Average Eu-154 activity		3.40E-02		
Sample standard deviation		5.36E-02		
95% upper confidence limit		**8.23E-02**		
Shapiro-Wilk p-value		0.343 (normal)		
a. L&V report SOS-TL009-06. b. Bold values are the result compared to RGs.				

Table B-6. CPP-37B characterization sampling results for Pu-238 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	-2.56E-02	--	U	3RA13001RN
37B-2	0 - 10 ft	2.76E-01	--	U	3RA13201RN
37B-3	0 - 10 ft	6.09E-01	--	J	3RA13401RN
37B-4	0 - 10 ft	8.08E-02	--	U	3RA13601RN
37B-5	0 - 10 ft	1.68E-02	--	U	3RA13801RN
37B-6	0 - 10 ft	4.18E-01	--	U	3RA14001RN
Statistical data (0-10 ft)					
Average Pu-238 activity		2.29E-01			
Sample standard deviation		2.51E-01			
95% upper confidence limit		**4.28E-01**			
Shapiro-Wilk p-value		0.512 (normal)			
37B-1	10 - 35 ft	0.00E+00	undefined	U	3RA13101RN
37B-2	10 - 35 ft	4.78E-03	-5.343	U	3RA13301RN
37B-3	10 - 35 ft	1.52E-01	-1.884	U	3RA13501RN
37B-5	10 - 35 ft	1.17E-03	-6.751	U	3RA13901RN
37B-6	10 - 35 ft	**5.54E-01**	-0.591	J	3RA14101RN
Statistical data (10-35 ft)					
Average Pu-238 activity		1.42E-01	--		
Sample standard deviation		2.39E-01	--		
95% upper confidence limit		3.58E-01	--		
Shapiro-Wilk p-value		0.014 (not normal)	0.000 (not log-normal)		

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs. Maximum values are used for data with no assumed distribution.
c. -- represents values not reported.

Table B-7. CPP-37B characterization sampling results for Pu239/240 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	4.56E-01	U	3RA13001RN
37B-2	0 - 10 ft	4.27E-01	U	3RA13201RN
37B-3	0 - 10 ft	2.99E-01	U	3RA13401RN
37B-4	0 - 10 ft	1.06E-01	U	3RA13601RN
37B-5	0 - 10 ft	8.43E-03	U	3RA13801RN
37B-6	0 - 10 ft	2.46E-01	U	3RA14001RN
Statistical data (0-10 ft)				
Average Pu-239/240 activity		2.57E-01		
Sample standard deviation		1.76E-01		
95% upper confidence limit		**3.97E-01**		
Shapiro-Wilk p-value		0.695 (normal)		
37B-1-Dup.	10 - 35 ft	3.01E-01	U	3RA13102RN
37B-2	10 - 35 ft	-5.26E-02	U	3RA13301RN
37B-3	10 - 35 ft	2.39E-01	U	3RA13501RN
37B-5	10 - 35 ft	2.23E-02	U	3RA13901RN
37B-6	10 - 35 ft	2.32E-01	U	3RA14101RN
Statistical data (10-35 ft)				
Average Pu-239/240 activity		1.48E-01		
Sample standard deviation		1.54E-01		
95% upper confidence limit		**2.87E-01**		
Shapiro-Wilk p-value		0.270 (normal)		
a. L&V report SOS-TL009-06. b. Bold values are the result compared to RGs.				

Table B-8. CPP-37B characterization sampling results for Pu-241 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[b,c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	1.03E+02	4.635		3RA13001RN
37B-2	0 - 10 ft	4.78E-01	-0.738	U	3RA13201RN
37B-3	0 - 10 ft	2.45E+01	3.199	J	3RA13401RN
37B-4	0 - 10 ft	1.61E+01	2.779	U	3RA13601RN
37B-5	0 - 10 ft	2.41E+02	5.485		3RA13801RN
37B-6	0 - 10 ft	1.62E+01	2.785	U	3RA14001RN
Statistical data (0-10 ft)					
Average Pu-241 activity		6.69E+01	3.02		
Sample standard deviation		9.27E+01	2.14		
95% upper confidence limit		1.40E+02	**4.72**		
Shapiro-Wilk p-value		0.021 (not normal)	0.407 (log-normal)		
37B-1	10 - 35 ft	2.30E+00	--	U	3RA13101RN
37B-2	10 - 35 ft	0.00E+00	--	U	3RA13301RN
37B-3	10 - 35 ft	4.50E+00	--	U	3RA13501RN
37B-5	10 - 35 ft	2.09E+01	--	U	3RA13901RN
37B-6	10 - 35 ft	7.41E+00	--	U	3RA14101RN
Statistical data (10-35 ft)					
Average Pu-241 activity		7.02E+00			
Sample standard deviation		8.23E+00			
95% upper confidence limit		**1.44E+01**			
Shapiro-Wilk p-value		0.179 (normal)			

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs.
c. -- represents values not reported.

Table B-9. CPP-37B characterization sampling results for Sr-90 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37B-1	0 - 10 ft	1.55E+00	0.438		3RA13001RH
37B-2	0 - 10 ft	3.76E-01	-0.978		3RA13201RH
37B-3	0 - 10 ft	4.06E-01	-0.901		3RA13401RH
37B-4	0 - 10 ft	**1.84E+00**	0.610		3RA13601RH
37B-5	0 - 10 ft	1.67E+00	0.513		3RA13801RH
37B-6	0 - 10 ft	4.50E-01	-0.799		3RA14001RH
Statistical data (0-10 ft)					
Average Sr-90 activity		1.05E+00	--		
Sample standard deviation		7.05E-01	--		
95% upper confidence limit		1.61E+00	--		
Shapiro-Wilk p-value		0.039 (not normal)	0.031 (not log-normal)		
37B-1	10 - 35 ft	5.12E-01	-0.669		3RA13101RH
37B-2	10 - 35 ft	**4.15E+00**	1.423		3RA13301RH
37B-3	10 - 35 ft	7.31E-01	-0.313		3RA13501RH
37B-5	10 - 35 ft	4.52E-01	-0.794		3RA13901RH
37B-6	10 - 35 ft	6.96E-01	-0.362		3RA14101RH
Statistical data (10-35 ft)					
Average Sr-90 activity		1.31E+00	--		
Sample standard deviation		1.59E+00	--		
95% upper confidence limit		2.74E+00	--		
Shapiro-Wilk p-value		0.001 (not normal)	0.032 (not log-normal)		

a. L&V report SOS-TL338-05.
b. Bold values are the result compared to RGs. Maximum values are used for data with no assumed distribution.
c. -- represents values not reported.

Table B-10. CPP-37C characterization sampling results for Hg for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Concentration[a,b] (mg/kg)	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	1.30E-02	U	3RA15701LA
37C-7	0 - 10 ft	1.90E-02	U	3RA15801LA
37C-8	0 - 10 ft	3.90E-02	UJ	3RA16001LA
37C-9	0 - 10 ft	2.70E-02	UJ	3RA16101LA
37C-10	0 - 10 ft	3.30E-02	U	3RA15001LA
37C-11	0 - 10 ft	5.30E-02	U	3RA15101LA
37C-12	0 - 10 ft	4.30E-02	U	3RA15201LA
37C-13	0 - 10 ft	3.10E-02	U	3RA15301LA
37C-14	0 - 10 ft	3.70E-02	U	3RA15401LA
37C-15	0 - 10 ft	1.30E-02	U	3RA15501LA
37C-16	0 - 10 ft	1.30E-02	U	3RA15601LA
Statistical data (0-10 ft)				
Average Hg concentration		2.92E-02		
Sample standard deviation		1.35E-02		
95% upper confidence limit		**3.65E-02**		
Shapiro-Wilk p-value		0.411 (normal)		
37C-6	10 - 20 ft	1.30E-02	U	3RA14601LA
37C-7	10 - 20 ft	1.30E-02	U	3RA14701LA
37C-8	10 - 20 ft	2.60E-02	U	3RA14801LA
37C-9	10 - 20 ft	3.90E-02	U	3RA14901LA
37C-10	10 - 20 ft	3.10E-02	UJ	3RA16201LA
37C-11	10 - 20 ft	2.80E-02	UJ	3RA16301LA
37C-12	10 - 20 ft	2.30E-02	UJ	3RA14201LA
37C-13	10 - 20 ft	3.10E-02	UJ	3RA14301LA
37C-14	10 - 20 ft	3.70E-02	J	3RA14401LA
37C-15	10 - 20 ft	1.30E-02	UJ	3RA14501LA
37C-16	10 - 20 ft	1.30E-02	J	3RA14402LA
Statistical data (10-20 ft)				
Average Hg concentration		2.43E-02		
Sample standard deviation		9.98E-03		
95% upper confidence limit		**2.97E-02**		
Shapiro-Wilk p-value		0.089 (normal)		
a. L&V report DNT-010-06. b. Bold values are the result compared to RGs.				

Table B-11. CPP-37C characterization sampling results for Am-241 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[b,c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	7.18E-01	--	J	3RA14201RN
37C-7	0 - 10 ft	4.31E-01	--	U	3RA14402RN
37C-8	0 - 10 ft	-4.21E-02	--	U	3RA14601RN
37C-9	0 - 10 ft	1.83E-01	--	U	3RA14801RN
37C-10	0 - 10 ft	5.01E-01	--	U	3RA15001RN
37C-11	0 - 10 ft	3.48E-01	--	U	3RA15201RN
37C-12	0 - 10 ft	2.89E-01	--	U	3RA15401RN
37C-13	0 - 10 ft	9.46E-01	--		3RA15601RN
37C-14	0 - 10 ft	1.62E-01	--	U	3RA15801RN
37C-15	0 - 10 ft	3.42E-01	--	U	3RA16001RN
37C-16	0 - 10 ft	5.70E-01	--	U	3RA16201RN
Statistical data (0-10 ft)					
Average Am-241 activity		4.04E-01			
Sample standard deviation		2.75E-01			
95% upper confidence limit		**5.53E-01**			
Shapiro-Wilk p-value		0.973 (normal)			
37C-6	10 - 20 ft	2.88E-01	-1.245	U	3RA14301RN
37C-7	10 - 20 ft	5.07E-01	-0.679	U	3RA14501RN
37C-8	10 - 20 ft	4.50E-01	-0.799	U	3RA14701RN
37C-9	10 - 20 ft	8.19E-01	-0.200		3RA14901RN
37C-10	10 - 20 ft	3.83E-01	-0.960	U	3RA15101RN
37C-11	10 - 20 ft	3.98E-01	-0.921	U	3RA15301RN
37C-12	10 - 20 ft	6.70E-01	-0.400	U	3RA15501RN
37C-13	10 - 20 ft	1.93E-01	-1.645	U	3RA15701RN
37C-14	10 - 20 ft	1.59E+00	0.637		3RA15901RN
37C-15	10 - 20 ft	6.82E-01	-0.383	J	3RA16101RN
37C-16	10 - 20 ft	5.62E-01	-0.576	J	3RA16301RN
Statistical data (10-20 ft)					
Average Am-241 activity		5.95E-01	-0.652		
Sample standard deviation		3.77E-01	0.595		
95% upper confidence limit		7.99E-01	**-0.365**		
Shapiro-Wilk p-value		0.012 (not normal)	0.970 (log-normal)		

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs.
c. -- represents values not reported.

Table B-12. CPP-37C characterization sampling results for Cs-137 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activit[b,c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	1.86E+00	--		3RA14201RN
37C-7-Dup.	0 - 10 ft	1.37E+00	--	U	3RA14402RN
37C-8	0 - 10 ft	1.47E+00	--		3RA14601RN
37C-9	0 - 10 ft	3.62E+00	--		3RA14801RN
37C-10	0 - 10 ft	5.38E-02	--		3RA15001RN
37C-11	0 - 10 ft	1.53E+00	--		3RA15201RN
37C-12	0 - 10 ft	8.51E-01	--		3RA15401RN
37C-13	0 - 10 ft	7.69E-05	--	U	3RA15601RN
37C-14	0 - 10 ft	2.54E+00	--		3RA15801RN
37C-15	0 - 10 ft	9.61E-01	--		3RA16001RN
37C-16	0 - 10 ft	2.91E+00	--		3RA16201RN
Statistical data (0-10 ft)					
Average Cs-137 activity		1.56E+00			
Sample standard deviation		1.13E+00			
95% upper confidence limit		**2.17E+00**			
Shapiro-Wilk p-value		0.772 (normal)			
37C-6	10 - 20 ft	2.99E-02	-3.510	U	3RA14301RN
37C-7	10 - 20 ft	2.29E-02	-3.777	U	3RA14501RN
37C-8	10 - 20 ft	3.69E+00	1.306		3RA14701RN
37C-9-Dup.	10 - 20 ft	1.65E-02	-4.104	U	3RA14902RN
37C-10	10 - 20 ft	5.70E-05	-9.772	U	3RA15101RN
37C-11	10 - 20 ft	5.19E-05	-9.866	U	3RA15301RN
37C-12	10 - 20 ft	3.39E-01	-1.082		3RA15501RN
37C-13	10 - 20 ft	8.65E-05	-9.355	U	3RA15701RN
37C-14	10 - 20 ft	9.85E-01	-0.015	U	3RA15901RN
37C-15	10 - 20 ft	4.89E-03	-5.321	U	3RA16101RN
37C-16	10 - 20 ft	9.62E-02	-2.341		3RA16301RN
Statistical data (10-20 ft)					
Average Cs-137 activity		4.71E-01	-4.349		
Sample standard deviation		1.11E+00	3.904		
95% upper confidence limit		1.07E+00	**-2.23**		
Shapiro-Wilk p-value		0.000 (not normal)	0.304 (log-normal)		

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs.
c. -- represents values not reported.

Table B-13. CPP-37C characterization sampling results for Eu-152 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	1.00E-02	-4.605	U	3RA14201RN
37C-7	0 - 10 ft	3.78E-02	-3.275	U	3RA14402RN
37C-8	0 - 10 ft	-4.40E-03	--	U	3RA14601RN
37C-9	0 - 10 ft	1.39E-02	-4.276	U	3RA14801RN
37C-10	0 - 10 ft	-1.20E-04	--	U	3RA15001RN
37C-11	0 - 10 ft	1.14E-04	-9.079	U	3RA15201RN
37C-12	0 - 10 ft	-1.20E-04	--	U	3RA15401RN
37C-13	0 - 10 ft	**6.89E-02**	-2.675	U	3RA15601RN
37C-14	0 - 10 ft	-2.91E-02	--	U	3RA15801RN
37C-15	0 - 10 ft	1.47E-04	-8.825	U	3RA16001RN
37C-16	0 - 10 ft	1.43E-04	-8.823	U	3RA16201RN
Statistical data (0-10 ft)					
Average Eu-152 activity		8.84E-03	--		
Sample standard deviation		2.54E-02	--		
95% upper confidence limit		2.26E-02	--		
Shapiro-Wilk p-value		0.026 (not normal)	0.000 (not log-normal)		
37C-6	10 - 20 ft	3.87E-02	-3.252	U	3RA14301RN
37C-7	10 - 20 ft	-5.58E-03	--	U	3RA14501RN
37C-8	10 - 20 ft	6.49E-02	-2.735	U	3RA14701RN
37C-9	10 - 20 ft	4.45E-02	-3.112	U	3RA14902RN
37C-10	10 - 20 ft	1.37E-04	-8.896	U	3RA15101RN
37C-11	10 - 20 ft	1.25E-04	-8.987	U	3RA15301RN
37C-12	10 - 20 ft	1.41E-04	-8.867	U	3RA15501RN
37C-13	10 - 20 ft	2.20E-02	-3.817	U	3RA15701RN
37C-14	10 - 20 ft	-1.63E-02	--	U	3RA15901RN
37C-15	10 - 20 ft	1.82E-01	-1.704	U	3RA16101RN
37C-16	10 - 20 ft	**1.89E-01**	-1.666	U	3RA16301RN
Statistical data (10-20 ft)					
Average Eu-152 activity		4.72E-02	--		
Sample standard deviation		0.0726427	--		
95% upper confidence limit		8.66E-02	--		
Shapiro-Wilk p-value		0.003 (not normal)	0.000 (not log-normal)		

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs. Maximum values are used for data with no assumed distribution.
c. -- represents values not reported.

Table B-14. CPP-37C characterization sampling results for Eu-154 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	4.39E-02	U	3RA14201RN
37C-7-Dup.	0 - 10 ft	8.01E-02	U	3RA14402RN
37C-8	0 - 10 ft	7.65E-02	U	3RA14601RN
37C-9	0 - 10 ft	8.35E-02	U	3RA14801RN
37C-10	0 - 10 ft	-4.59E-02	U	3RA15001RN
37C-11	0 - 10 ft	6.60E-02	U	3RA15201RN
37C-12	0 - 10 ft	5.20E-02	U	3RA15401RN
37C-13	0 - 10 ft	-1.67E-02	U	3RA15601RN
37C-14	0 - 10 ft	-9.93E-03	U	3RA15801RN
37C-15	0 - 10 ft	-9.67E-02	U	3RA16001RN
37C-16	0 - 10 ft	-7.89E-03	U	3RA16201RN
Statistical data (0-10 ft)				
Average Eu-154 activity		2.04E-02		
Sample Standard deviation		5.96E-02		
95% upper confidence limit		**5.27E-02**		
Shapiro-Wilk p-value		0.186 (normal)		
37C-6	10 - 20 ft	3.31E-02	U	3RA14301RN
37C-7	10 - 20 ft	6.00E-02	U	3RA14501RN
37C-8	10 - 20 ft	3.03E-02	U	3RA14701RN
37C-9-Dup.	10 - 20 ft	9.15E-02	U	3RA14902RN
37C-10	10 - 20 ft	-8.79E-02	U	3RA15101RN
37C-11	10 - 20 ft	-8.79E-02	U	3RA15301RN
37C-12	10 - 20 ft	-2.47E-03	U	3RA15501RN
37C-13	10 - 20 ft	-1.44E-02	U	3RA15701RN
37C-14	10 - 20 ft	-5.86E-02	U	3RA15901RN
37C-15	10 - 20 ft	-6.95E-02	U	3RA16101RN
37C-16	10 - 20 ft	1.33E-01	U	3RA16301RN
Statistical data (10-20 ft)				
Average Eu-154 activity		2.47E-03		
Sample standard deviation		7.45E-02		
95% upper confidence limit		**4.28E-02**		
Shapiro-Wilk p-value		0.544 (normal)		

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs.

Table B-15. CPP-37C characterization sampling results for Pu-238 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	2.61E-01	--	U	3RA14201RN
37C-7-Dup.	0 - 10 ft	4.57E-01	--	U	3RA14402RN
37C-8	0 - 10 ft	1.73E-02	--	U	3RA14601RN
37C-9	0 - 10 ft	3.20E-01	--	U	3RA14801RN
37C-10	0 - 10 ft	9.60E-03	--	U	3RA15001RN
37C-11	0 - 10 ft	3.79E-03	--	U	3RA15201RN
37C-12	0 - 10 ft	5.00E-02	--	U	3RA15401RN
37C-13	0 - 10 ft	3.39E-01	--	U	3RA15601RN
37C-14	0 - 10 ft	4.87E-01	--	J	3RA15801RN
37C-15	0 - 10 ft	5.26E-01	--	J	3RA16001RN
37C-16	0 - 10 ft	5.49E-01	--	U	3RA16201RN
Statistical data (0-10 ft)					
Average Pu-238 activity		2.75E-01			
Sample standard deviation		2.20E-01			
95% upper confidence limit		**3.94E-01**			
Shapiro-Wilk p-value		0.067 (normal)			
37C-6	10 - 20 ft	0.00E+00	--	U	3RA14301RN
37C-7	10 - 20 ft	2.42E+00	0.884		3RA14501RN
37C-8	10 - 20 ft	-6.15E-02	--	U	3RA14701RN
37C-9	10 - 20 ft	**2.50E+00**	0.916		3RA14901RN
37C-10	10 - 20 ft	1.09E-02	-4.519	U	3RA15101RN
37C-11	10 - 20 ft	-2.43E-03	--	U	3RA15301RN
37C-12	10 - 20 ft	-2.39E-06	--	U	3RA15501RN
37C-13	10 - 20 ft	1.76E-02	-4.040	U	3RA15701RN
37C-14	10 - 20 ft	1.20E-03	-6.725	U	3RA15901RN
37C-15	10 - 20 ft	1.74E+00	0.554		3RA16101RN
37C-16	10 - 20 ft	5.05E-01	-0.683	J	3RA16301RN
Statistical data (10-20 ft)					
Average Pu-238 activity		6.48E-01	--		
Sample standard deviation		1.04E+00	--		
95% upper confidence limit		1.21E+00	--		
Shapiro-Wilk p-value		0.000 (not normal)	0.000 (not log-normal)		

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs. Maximum values are used for data with no assumed distribution.
c. -- represents values not reported.

Table B-16. CPP-37C characterization sampling results for Pu-239/240 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	1.67E-02	-1.790	U	3RA14201RN
37C-7	0 - 10 ft	**6.04E-01**	-0.504	J	3RA14401RN
37C-8	0 - 10 ft	8.68E-02	-2.444	U	3RA14601RN
37C-9	0 - 10 ft	2.46E-02	-3.705	U	3RA14801RN
37C-10	0 - 10 ft	1.20E-03	-6.725	U	3RA15001RN
37C-11	0 - 10 ft	3.16E-02	-3.455	U	3RA15201RN
37C-12	0 - 10 ft	-2.51E-03	--	U	3RA15401RN
37C-13	0 - 10 ft	2.18E-01	-1.523	U	3RA15601RN
37C-14	0 - 10 ft	4.40E-01	-0.821	J	3RA15801RN
37C-15	0 - 10 ft	1.01E-01	-2.293	U	3RA16001RN
37C-16	0 - 10 ft	5.92E-01	-0.524	J	3RA16201RN
Statistical data (0-10 ft)					
Average Pu-239/240 activity		1.92E-01	--		
Sample standard deviation		2.39E-01	--		
95% upper confidence limit		3.21E-01	--		
Shapiro-Wilk p-value		0.004 (not normal)	0.000 (not log-normal)		
37C-6	10 - 20 ft	1.08E+00	0.077		3RA14301RN
37C-7	10 - 20 ft	**2.48E+00**	0.091		3RA14501RN
37C-8	10 - 20 ft	3.70E-01	-0.994	U	3RA14701RN
37C-9-Dup.	10 - 20 ft	4.18E-01	-0.879	J	3RA14902RN
37C-10	10 - 20 ft	-2.44E-03	--	U	3RA15101RN
37C-11	10 - 20 ft	-1.22E-02	--	U	3RA15301RN
37C-12	10 - 20 ft	-4.93E-03	--	U	3RA15501RN
37C-13	10 - 20 ft	1.17E-02	-4.448	U	3RA15701RN
37C-14	10 - 20 ft	-4.80E-03	--	U	3RA15901RN
37C-15	10 - 20 ft	1.63E-01	-1.814	U	3RA16101RN
37C-16	10 - 20 ft	3.22E-01	-1.133	U	3RA16301RN
Statistical data (10-20 ft)					
Average Pu-239/240 activity		4.38E-01	--		
Sample standard deviation		7.51E-01	--		
95% upper confidence limit		8.45E-01	--		
Shapiro-Wilk p-value		0.000 (not normal)	0.000 (not log-normal)		

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs. Maximum values are used for data with no assumed distribution.
c. -- represents values not reported.

Table B-17. CPP-37B characterization sampling results for Pu-241 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[b,c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	2.91E+01	--	J	3RA14201RN
37C-7	0 - 10 ft	1.75E+01	--	U	3RA14401RN
37C-8	0 - 10 ft	-1.70E+00	--	U	3RA14601RN
37C-9	0 - 10 ft	7.41E+00	--	U	3RA14801RN
37C-10	0 - 10 ft	2.03E+01	--	U	3RA15001RN
37C-11	0 - 10 ft	1.41E+01	--	U	3RA15201RN
37C-12	0 - 10 ft	1.17E+01	--	U	3RA15401RN
37C-13	0 - 10 ft	3.83E+01	--		3RA15601RN
37C-14	0 - 10 ft	6.56E+00	--	U	3RA15801RN
37C-15	0 - 10 ft	1.39E+01	--	U	3RA16001RN
37C-16	0 - 10 ft	2.31E+01	--	U	3RA16201RN
Statistical data (0-10 ft)					
Average Pu-241 activity		1.64E+01			
Sample standard deviation		1.11E+01			
95% upper confidence limit		**2.24E+01**			
Shapiro-Wilk p-value		0.974 (normal)			
37C-6	10 - 20 ft	1.17E+01	2.46	U	3RA14301RN
37C-7	10 - 20 ft	2.05E+01	3.02	U	3RA14501RN
37C-8	10 - 20 ft	1.82E+01	2.90	U	3RA14701RN
37C-9	10 - 20 ft	3.32E+01	3.50		3RA14901RN
37C-10	10 - 20 ft	1.55E+01	2.74	U	3RA15101RN
37C-11	10 - 20 ft	1.61E+01	2.78	U	3RA15301RN
37C-12	10 - 20 ft	2.71E+01	3.30	U	3RA15501RN
37C-13	10 - 20 ft	7.82E+00	2.06	U	3RA15701RN
37C-14	10 - 20 ft	6.44E+01	4.17		3RA15901RN
37C-15	10 - 20 ft	2.76E+01	3.32	J	3RA16101RN
37C-16	10 - 20 ft	2.28E+01	3.13	J	3RA16301RN
Statistical data (10-20 ft)					
Average Pu-241 activity		2.41E+01	3.04		
Sample standard deviation		1.53E+01	0.56		
95% upper confidence limit		3.24E+01	**3.34**		
Shapiro-Wilk p-value		0.012 (not normal)	0.970 (log-normal)		

a. L&V report SOS-TL009-06.
b. Bold values are the result compared to RGs.
c. -- represents values not reported.

Table B-18. CPP-37C characterization sampling results for Sr-90 for composited soil samples.

Location	Sample Depth Represented by the Composite	Sample Activity[a,b] (pCi/g)	Natural Log-Transformed Activity[b,c] [ln(pCi/g)]	Validation Flag	Field Sample Number
37C-6	0 - 10 ft	3.77E-01	-0.976		3RA14201RH
37C-7	0 - 10 ft	6.57E-01	-0.420		3RA14401RH
37C-8	0 - 10 ft	6.71E-01	-0.399		3RA14601RH
37C-9	0 - 10 ft	3.41E+00	1.227		3RA14801RH
37C-10	0 - 10 ft	2.60E-01	-1.347	UJ	3RA15001RH
37C-11	0 - 10 ft	1.00E-01	-2.303	U	3RA15201RH
37C-12	0 - 10 ft	8.90E-01	-0.117		3RA15401RH
37C-13	0 - 10 ft	1.23E-01	-2.096	U	3RA15601RH
37C-14	0 - 10 ft	4.63E+00	1.533		3RA15801RH
37C-15	0 - 10 ft	7.11E-01	-0.341		3RA16001RH
37C-16	0 - 10 ft	6.17E-01	-0.483		3RA16201RH
Statistical data (0-10 ft)					
Average Sr-90 activity		1.13E+00	-0.520		
Sample standard deviation		1.48E+00	1.185		
95% upper confidence limit		1.93E+00	**0.259**		
Shapiro-Wilk p-value		0.000 (not normal)	0.462 (log-normal)		
37C-6	10 - 20 ft	2.30E-01	-1.470	UJ	3RA14301RH
37C-7	10 - 20 ft	8.90E-02	-2.419	U	3RA14501RH
37C-8	10 - 20 ft	**1.86E+01**	2.923		3RA14701RH
37C-9	10 - 20 ft	2.23E-01	-1.501		3RA14901RH
37C-10	10 - 20 ft	8.90E-02	-2.419	U	3RA15101RH
37C-11	10 - 20 ft	1.16E-01	-2.154	U	3RA15301RH
37C-12	10 - 20 ft	2.54E-01	-1.370		3RA15501RH
37C-13	10 - 20 ft	5.00E-02	-2.996	U	3RA15701RH
37C-14	10 - 20 ft	5.90E-01	-0.528		3RA15901RH
37C-15	10 - 20 ft	3.90E-02	-3.244	U	3RA16101RH
37C-16	10 - 20 ft	2.66E-01	-1.324		3RA16301RH
Statistical data (10-20 ft)					
Average Sr-90 activity		1.87E+00	--		
Sample standard deviation		5.55E+00	--		
95% upper confidence limit		4.87E+00	--		
Shapiro-Wilk p-value		0.000 (not normal)	0.008 (not log-normal)		

a. L&V report SOS-TL338-05.
b. Bold values are the result compared to RGs. Maximum values are used for data with no assumed distribution.
c. -- represents values not reported.